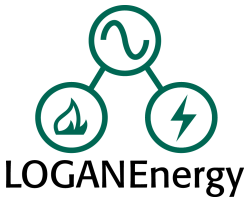

W91321-04-C-0023

LOGANEnergy Corp.

Hill AFB PEM Demonstration Project
Initial Project Report

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Hill Air Force Base, UT Main Base Fire Station, Building #9

10 August 2004

Executive Summary

Under terms of its FY'03 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy will install and operate a Plug Power GenSys 5kWe Combined Heat and Power fuel cell power plant at Hill AFB. The site selected for the one-year demonstration project is Building 9, the Base Fire Station. The unit will be electrically configured to provide grid parallel/grid independent service to the fire station and it will also be thermally integrated with the facility's hot water system to support domestic hot water loads. Local electrical and mechanical contractors will be hired to provide services as needed to support the installation tasks. It is anticipated that the project will add $1,024 in annual energy costs to Hill ARB during the period of performance.

The Hill AFB POC for this project is David Abbott whose coordinates are:

Base Utility Manager/Energy Management Office
75 CES/CEEE Hill AFB, UT
Comm.: 801-777-5944
DSN: 777-5944 FAX: 777-594
David.Abbott@HILL.af.mil

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

LOGANEnergy Corp. Small Scale PEM 2004 Demonstration Project at Hill AFB, UT

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 22 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCor 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Scott Wilshire is the Plug Power point of contact for this project. His phone number is 518.782.7700 ex1338, and his email address is scott_wilshire@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Four-year PC25 PM Services Maintenance Agreement.
In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD. .

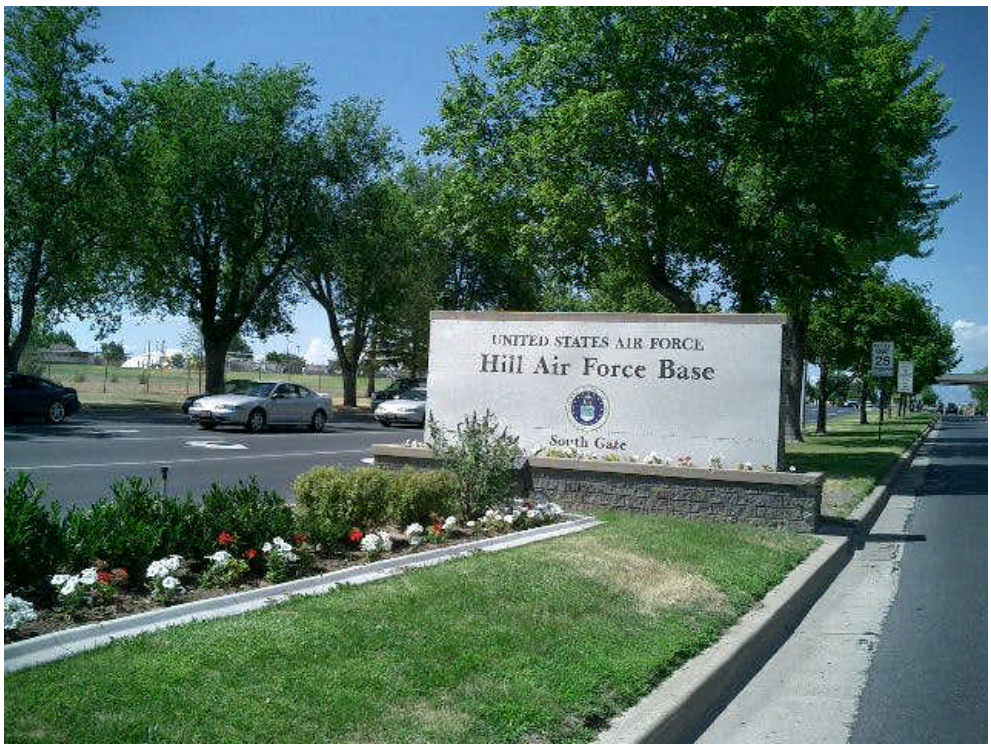
Plug Power
Mr. Scott Wilshire.
968 Albany Shaker Rd.
Latham, NY 12110
(518) 782-7700 ex 1338

c) Contract: A Partners LLC Commercial Fuel Cell Project Design, Installation and 5-year service and maintenance agreement on 600kW UTC PC25 power block.

Contract # A Partners LLC, 12/31/01

Mr. Ron Allison
A Partner LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

7.0 Host Facility Information



Hill Air Force Base is an **Air Force Materiel Command** base located in northern Utah. Hill is home to many operational and support missions, with the Ogden Air Logistics Center (OO-ALC) serving as the host organization. The center provides worldwide engineering and logistics management for the **F-16 Fighting Falcon**, **A-10 Thunderbolt**, **Minuteman III** and **Peacekeeper** intercontinental ballistic missiles. The base performs depot maintenance of the F-16, A-10 and **C-130 Hercules** aircraft.

The center is responsible for Air Force-wide item management, depot-level overhaul and repair for all types of landing gear, aircraft wheels, brakes and tires. The logistics for all conventional air munitions, solid propellants and explosive devices used throughout the Air Force are managed at Hill AFB. The center is the Air Force Center of Industrial and Technical Excellence (CITE) for low-observable (*'stealth'*) aircraft structural composite materials and provides support for the **B-2 Spirit** multi-role bomber.

A full range of sustainment and logistics support is provided for space and command, control, communication and intelligence systems. The center provides worldwide logistical support for mature (**T-37**, **T-38**) and proven (F-4, F-5, F-111, OV-10) aircraft.

Hill is also responsible for providing photonics imaging and reconnaissance equipment; aircraft and missile crew training devices; avionic, hydraulic, pneudraulic and radar components; instruments; gas turbine engines; power equipment systems; special purpose vehicles; shelters; and software engineering, development and support.

Getting to Hill AFB is easy. It's located right off Interstate 15, about 30 miles north of Salt Lake City. Once you get on base through the South, West or the Roy Gates, security will direct you to parking. Hill is located along the Wasatch Front, the mountain chain just to the east. To the north of the base, the closest major city is Ogden.

8.0 Fuel Cell Site Information

The photo at left below is a picture of the entrance to the Hill AFB Fire Station Hill, which is the new site for the PEM project. Following the initial site visit on July 15, LOGAN and the base POC reached initial consensus that the Base Wing Commander's residence could provide a good opportunity to install the fuel cell to best effect. However, during the kick-off meeting on 27 July 2004, the POC reveled that the new base housing privatization program would prevent the original plan from going forward. In the insuring discussions, the Hill POC and LOGAN decided to tour the base fire station to determine its suitability for the project. Following that, the facility was chosen to host the project.

The photo at right below shows the approximate location of the fuel cell pad at the rear of the building adjacent to the natural gas service. The gas service piping penetrates the building at a point just below the regulator, and terminates at a hot water heater located in a closet 15 feet away from the exterior wall. LOGAN will use the same wall penetration and follow the same routing to install its thermal recovery piping to the water tank.

The building does not currently have high speed Ethernet service, but the POC has offered assistance to acquire the service. The installation plan will simulate a critical load application by wiring appropriate circuits to the fuel cell's emergency load panel.

9.0 Electrical System

The Plug Power GenSys 5C PEM fuel cell power plant provides both gird parallel and grid independent operating configurations for site power management. This capability is an important milestone in the development of the Gensys5 product commercialization schedule. The unit has a power output of 110/120 VAC at 60 Hz, and when necessary the voltage can be adjusted to 208vac or 220vac depending upon actual site conditions. The photo below shows the electrical service panel in the fire station where the fuel cell will be electrically coupled to the base utility grid. On the wall adjacent to the service panel, LOGAN will attach a new emergency service panel and consult with the POC to select the appropriate circuits to transfer to it.

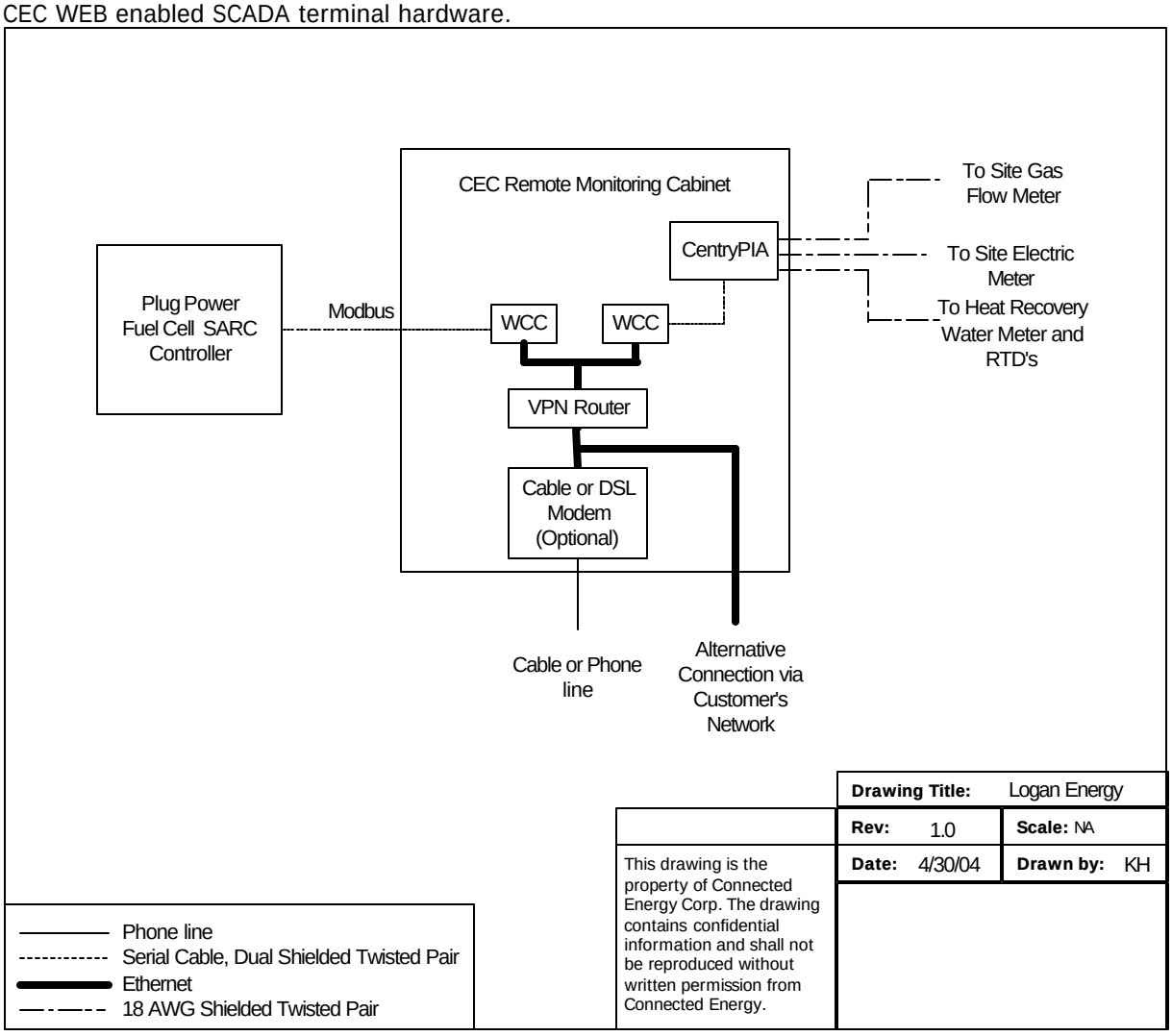
10.0 Thermal Recovery System

LOGAN intends to employ a Heliodyne heat exchanger to capture fuel cell waste heat and transfer it into the fire station's hot water heater pictured at left below. The Heliodyne is a looped coil within a coil design that provides double wall protection between the heat source and the heat sink. It was designed primarily for the solar heating industry, but has proved to be very adaptable to the fuel cell industry as well. The Heliodyne will mount either directly to the storage tank or on an adjacent wall. It has its own pump that circulates the storage tank in a counter flow against incoming hot water provided by the fuel cell's heat exchanger. While operating at a set point of 2.5 kWh, the fuel cell provides 7800 Btuh to the storage tank at approximately 140 degrees F. The photo at right below is taken of a similar fuel cell installation scheme using a Heliodyne at Lt. Col Luster's residence at Ft. McPherson, GA. Note the heat exchanger secured to the wall behind the hot water heater.

11.0 Data Acquisition System

LOGAN proposes to install a Connected Energy Corporation web based SCADA system that provides high-speed access to real time monitoring of the power plant. The schematic drawing seen below describes the architecture of the CEC hardware that will support the project. The system provides a comprehensive data acquisition solution and also incorporates remote control, alarming, notification, and reporting functions. The system will pick up and display a number of fuel cell operating parameters on functional display screens including kWH, cell stack voltage, and water management, as well as external instrumentation inputs including Btus, fuel flow, and thermal loop temperatures. CEC's Operations Control Center in Rochester, New York maintains connectivity by means of a Virtual Private Network that will link the fuel cell to the center.

CEC WEB enabled SCADA terminal hardware.



LOGAN will procure high-speed Internet access to the fuel cell router from a local DSL or cable service provider. The base will provide local dial tone to a phone jack that will be conveniently located in the basement of Building 9 to provide communications with the fuel cell data modem.

12.0 Economic Analysis

Hill AFB, UT

Project Utility Rates		
1) Water (per 1,000 gallons)	$	0.95
2) Utility (per KWH)		0.0473
3) Natural Gas (per MCF)	$	8.29

First Cost	**Estimated**	**Actual**
Plug Power 5 kW SU-1	$ 65,000.00	
Shipping	$ 2,800.00	
Installation electrical	$ 4,225.00	
Installation mechanical & thermal	$ 9,510.00	
Watt Meter, Instrumentation, Web Package	$ 12,500.00	
Site Prep, labor materials	$ 2,000.00	
Technical Supervision/Start-up	$ 2,500.00	
Total	**$ 98,535.00**	
Assume Five Year Simple Payback	$ 19,707.00	$ -

Forcast Operating Expenses	Volume	$/Hr	$/ Yr	
Natural Gas Mcf/ hr @ 2.5kW	0.0330	$ 0.27	$ 2,156.83	
Water Gallons per Year	14,016		$ 13.30	
Total Annual Operating Cost				$ 2,170.13

Economic Summary			
Forcast Annual kWH		19710	
Annual Cost of Operating Power Plant	$	0.110	kWH
Credit Annual Thermal Recovery Rate		($0.011)	kWH
Project Net Operating Cost	$	0.099	kWH
Displaced Utility cost	$	0.047	kWH
Energy Savings (Cost)		($0.052)	kWH
Annual Energy Savings (Cost)		($1,024.85)	

13.0 Kickoff Meeting Information

The project kick-off meeting occurred at 11:00 am on July 27, 2004. The attendees were Mr. David Abbott, Mr. Kent Nomura, Mr. Tim Hinno, Mr. Ron Call, Ms Amanda Anderson, Mr. Ben Crook, and Mr. Doug Arave representing Hill AFB. Dr. Mike Binder, represented CERL, and Sam Logan, represented LOGANEnergy. During the meeting it was revealed that due to a conflict with the base housing privatization schedule, the site for the PEM demonstration would have to be relocated from Col Romano's residence to another site. After much discussion, group consensus favored changing the site to the base Fire Station, Building 9.

14.0 Status/Timeline

See Appendix 2.

Appendix

1. Sample form used to qualify the fuel cell for initial start and the project acceptance test.

Installation / Acceptance Test Report

Site: Hill AFB, UT

Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	GC		
Stack Installed	GC		
Stack Coolant Installed	GC		
Air Purged from Stack Coolant	GC		
Radiator Coolant Installed	GC		
Air Purged from Radiator Coolant	GC		
J3 Cable Installed	GC		
J3 Cable Wiring Tested	GC		
Inverter Power Cable Installed	GC		
Inverter Power Polarity Correct	GC		
RS 232 /Modem Cable Installed	GC		
DI Solenoid Cable Installed with Diode	GC		
Natural Gas Pipe Installed	GC		
DI Water / Heat Trace Installed	GC		
Drain Tubing Installed	GC		

Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	GC		
SARC Name Correct	GC		
Start-Up Initiated	GC		
Coolant Leak Checked	GC		
Flammable Gas Leak Checked	GC		
Data Logging to Central Computer	GC		
System Run for 8 Hours with No Failures	GC		

Appendix 2

Hill AFB PEM Fuel Cell Demonstration Project

Installation, Monitoring, Performance Evaluations, & Reporting on One Plug Power PEM Fuel Cell At Base Fire Station, Bldg #9

Column Headings Indicate the Beginning of Each Month

Installation Schedule